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## 1. Computer Hardware

### ◆ What is Computer Hardware?

Computer hardware refers to the **physical components** of a computer system. These are the parts you can **touch and see**, unlike software, which is intangible.

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### ◆ Categories of Hardware:

#### 1. Input Devices

Allow users to input data into a computer.

- **Keyboard** – For typing.
- **Mouse** – For pointing and clicking.
- **Scanner** – Converts documents to digital format.
- **Webcam, Microphone, Joystick** – Other examples.

#### 2. Output Devices

Display or output data from the computer.

- **Monitor** – Visual display of information.
- **Printer** – Outputs documents on paper.
- **Speakers** – Output audio.

#### 3. Processing Device

The **CPU (Central Processing Unit)** is the brain of the computer.

- **Control Unit (CU)** – Directs operations.
- **Arithmetic Logic Unit (ALU)** – Performs calculations and logic.
- Speed measured in **GHz (Gigahertz)**.
- Types of CPUs: Intel, AMD, ARM (used in mobile).

#### 4. Storage Devices

- **Primary Storage (Main Memory):**
  - **RAM (Random Access Memory)**: Temporary memory; volatile.
  - **ROM (Read-Only Memory)**: Permanent; used during booting.
- **Secondary Storage (Permanent):**
  - **Hard Disk Drive (HDD)** – Slower but cheaper.
  - **Solid State Drive (SSD)** – Faster, no moving parts.

- **Optical Drives (CD/DVD) and USB Drives.**

## 5. Motherboard

- The main circuit board that connects all components.
- Contains:
  - CPU socket
  - RAM slots
  - Expansion slots (PCIe)
  - Chipsets
  - Power connectors

## 6. Power Supply Unit (PSU)

- Converts electricity from AC (wall) to DC (for components).
- Essential for the functioning of all internal parts.

## 7. Cooling Systems

- **Fans or heat sinks** remove excess heat.
- Some high-end systems use **liquid cooling**.

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### ◆ Other Important Components:

#### • BIOS / UEFI:

- Firmware that initializes hardware during boot-up.
- UEFI is the modern replacement of BIOS.

#### • Expansion Cards:

- Add more functions like video, sound, or network capabilities.
- Example: **Graphics card (GPU), Sound card, NIC.**

#### • Ports and Connectors:

- **USB, HDMI, Ethernet, VGA, Audio jacks**
- Used to connect peripherals to the motherboard.

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### Key Terms Summary:

Term	Meaning
CPU	Central unit for processing

Term	Meaning
RAM	Volatile working memory
SSD	Fast permanent storage
Motherboard	Connects all components
PSU	Power Supply Unit
BIOS/UEFI	Boot firmware for hardware setup

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## ❖ 2. Computer Components and Peripherals

### ◆ Internal Components (Inside the CPU Cabinet)

#### 1. CPU (Central Processing Unit)

- Main processor that executes instructions.
- Divided into **CU (Control Unit)** and **ALU (Arithmetic Logic Unit)**.

#### 2. Motherboard

- Primary circuit board housing CPU, memory, and connectors.
- Connects all internal and external components.

#### 3. RAM (Random Access Memory)

- Temporary storage for running programs.
- Volatile – data lost when power is off.

#### 4. ROM (Read Only Memory)

- Permanent storage used during boot process.
- Stores BIOS/UEFI firmware.

#### 5. Hard Drive / SSD

- Long-term storage.
- **HDD** = slower with mechanical parts.
- **SSD** = faster, no moving parts.

#### 6. Power Supply Unit (PSU)

- Converts AC to DC to power all internal components.

#### 7. Cooling System

- **Fans, Heat Sinks, Liquid Cooling** to prevent overheating.



◆ **External Peripherals (Connected from Outside)**

► **Input Devices**

Used to send data into the computer:

- **Keyboard**
- **Mouse**
- **Touchscreen**
- **Scanner**
- **Joystick**
- **Barcode Reader**

► **Output Devices**

Used to receive data from the computer:

- **Monitor** (LED, LCD)
- **Printers** (Inkjet, Laser)
- **Speakers**
- **Headphones**
- **Projectors**

► **Input/Output Devices (Both)**

- **Touchscreen**
- **External Hard Drives**
- **USB Drives**
- **CD/DVD Drives**
- **Webcam with Microphone**

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◆ **Ports and Connectors**

**Port Type    Use**

**USB**        Connect peripherals, data transfer

**HDMI**       Video and audio output

**VGA**        Video output (older monitors)

**Ethernet**    Wired internet connection

## **Port Type Use**

**Audio Jack** Connect speakers/headphones

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## **Examples of Common Peripheral Devices**

Peripheral	Type
Printer	Output
Webcam	Input
Pen Drive	Storage/I/O
Projector	Output
Game Controller	Input
External HDD	Storage/I/O
Biometric Scanner	Input

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## **Summary Pointers:**

- **Peripherals** are external devices that enhance functionality.
  - Input, Output, and Storage peripherals allow interaction with the system.
  - Modern systems use **plug-and-play** for quick peripheral detection.
  - USB, HDMI, and Bluetooth are common connection types.
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## **3. PC Basics, Hardware, OS, and Applications**

This topic covers how computers work at a basic level — from hardware to software and how they interact.

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### **◆ PC Basics**

- **PC (Personal Computer)** = A general-purpose computing device for individual use.
- **Main Units:**
  - **Input Unit:** Devices like keyboard/mouse.
  - **Processing Unit:** CPU.
  - **Storage Unit:** Hard drive/SSD.
  - **Output Unit:** Monitor/printer.

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#### ◆ Types of Hardware

##### 1. Input Hardware

- Keyboard, Mouse, Scanner, Microphone.

##### 2. Output Hardware

- Monitor, Printer, Speakers.

##### 3. Storage Devices

- Internal (HDD, SSD), External (Pen drives, External HDDs).

##### 4. Communication Devices

- Network cards (NIC), Routers, Modems.
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#### ◆ Operating System (OS)

An OS is system software that manages computer hardware and software resources and provides services for computer programs.

##### Main Functions:

- **Process Management:** Allocates CPU to tasks.
- **Memory Management:** Controls RAM usage.
- **File Management:** Organizes and stores data.
- **Device Management:** Manages I/O devices.
- **User Interface:** CLI (e.g., Linux Terminal), GUI (e.g., Windows).

##### Examples:

- Windows, Linux, macOS, Ubuntu, Android, iOS

##### Categories:

- Single-user vs Multi-user
  - Multitasking vs Single-tasking
  - Real-time OS, Embedded OS, Distributed OS
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#### ◆ Software Applications

##### 1. System Software

- OS, Utilities (antivirus, disk cleanup).

##### 2. Application Software

- Used for productivity: Word processors, Spreadsheets, Browsers.

### 3. Programming Software

- Compilers, IDEs (Visual Studio, Eclipse).
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#### ◆ Software Installation Basics

- Software can be installed from:
    - Installer (.exe, .msi files)
    - App stores
    - Command Line (Linux packages like .deb, apt install, etc.)
  - Always check:
    - **System requirements**
    - **Disk space**
    - **Permissions (Admin/root)**
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#### ◆ File Types and Extensions

File Type	Common Extensions
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Documents	.docx, .pdf
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Images	.jpg, .png, .bmp
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Audio	.mp3, .wav
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Video	.mp4, .avi
-------	------------

Executables	.exe, .msi
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Compressed	.zip, .rar
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#### ◆ Important PC Terms

Term	Meaning
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Booting	Starting the computer.
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BIOS/UEFI	Firmware for system startup.
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Driver	Software that allows hardware to work with OS.
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GUI/CLI	Graphical vs Command-line interface.
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Term	Meaning
File System	Way to store and organize files (e.g., NTFS).
Virtual Memory	Part of storage used as RAM when needed.

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### **Summary Pointers:**

- Hardware = Physical parts; Software = Programs running on hardware.
  - OS is essential for coordinating system resources.
  - Understanding file types, installation, and user interfaces is key for working with any system.
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## **6. Files and Permissions (Windows Server 2019 + Linux)**

This section covers file system management and permission handling in both **Windows Server 2019** and **Linux** environments.

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### **A. Windows Server 2019 – File Services and Permissions**

#### **File System Types:**

- **NTFS (New Technology File System)** – default and most secure
- **ReFS (Resilient File System)** – used for large-scale data integrity (not for OS drive)

#### **File Services Role:**

Installed via **Server Manager > Add Roles**

Key features:

- **Distributed File System (DFS)**: Enables access to files across multiple servers
  - **File Server Resource Manager (FSRM)**: Sets quotas, file screening
  - **SMB (Server Message Block)**: Protocol for file sharing
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#### **NTFS Permissions (Fine-Grained Control):**

Assigned per file or folder:

Permission	Description
Full Control	All actions allowed
Modify	Read/Write/Delete
Read & Execute	Read and run

<b>Permission</b>	<b>Description</b>
List Folder Contents	View folder content
Read	Open and view
Write	Modify file/folder

 *Permissions are cumulative but Deny overrides Allow.*

#### **Share vs NTFS Permissions:**

- **Share Permissions:** Set when folder is shared over network.
- **NTFS Permissions:** Set on the file system level.

**Effective Permission** = Most restrictive between Share and NTFS

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#### **Managing Access:**

- **Security Tab → Edit Permissions**
  - Use **Groups** (like Administrators, Users) for assigning roles
  - Use **Advanced Security Settings** for inheritance, auditing, and ownership
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## **B. Linux – Files and Permissions**

#### **File Types in Linux:**

- - Regular file
- d Directory
- l Symbolic link
- b Block device
- c Character device

You can see file types using:

ls -l

#### **File Permission Structure:**

Sample:

-rw-r--r-- 1 owner group 1024 Jul 25 08:30 file.txt

Breakdown:

- First char (-): file type
- Next 3 (rw-): Owner permissions

- Next 3 (r--): Group permissions
- Last 3 (r--): Others' permissions

### **Permission Types:**

#### **Symbol Meaning**

r        Read

w        Write

x        Execute

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### **Changing Permissions:**

- chmod – change permissions
- chmod 755 filename
- chown – change file owner
- chown user:group filename
- umask – default permissions for new files

### **Numeric Representation:**

#### **Number Permission**

7        rwx

6        rw-

5        r-x

4        r--

0        ---

E.g., chmod 764:

- Owner: rwx (7)
  - Group: rw- (6)
  - Others: r-- (4)
- 

### **File Access Management Tips:**

Task	Windows	Linux
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Set permission NTFS Permissions GUI chmod command

Ownership      Advanced Settings      chown

Default perms    Group Policy / ACL    umask

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## 7. User and Group Management (Windows Server 2019 + Linux)

Managing users and groups is essential for maintaining access control, security, and resource sharing in both Windows and Linux environments.

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### A. Windows Server 2019 – User and Group Management

#### Tools Used:

- Local Users and Groups (for local accounts)
  - Active Directory Users and Computers (ADUC) (for domain-based accounts)
  - PowerShell
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#### User Account Types:

- Local User – Exists only on a specific machine
  - Domain User – Managed centrally via Active Directory
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#### Creating Users (Local):

Steps:

1. Run → lusrmgr.msc
  2. Right-click Users → New User
  3. Fill in Username, Password, and configure options like:
    - User must change password
    - Password never expires
- 

#### User Properties:

- Group Membership
- Profile Path (user's home folder)

- Account Lockout settings
  - Login Hours restrictions
- 

 **Group Types:**

- **Security Groups** – For assigning permissions (e.g., Domain Users, Administrators)
- **Distribution Groups** – For email only (used with Exchange)

 **Group Scopes (in AD):**

Scope	Usage Area
Global	Permissions in any domain
Domain Local	Within local domain only
Universal	Cross-domain (entire forest)

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 **PowerShell Commands:**

```
# Create user
```

```
New-LocalUser -Name "User1" -Password (Read-Host -AsSecureString "Enter Password")
```

```
# Create group
```

```
New-LocalGroup -Name "DevTeam"
```

```
# Add user to group
```

```
Add-LocalGroupMember -Group "DevTeam" -Member "User1"
```

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 **B. Linux – User and Group Management**

 **User-Related Files:**

- /etc/passwd – User account info
  - /etc/shadow – Encrypted passwords
  - /etc/group – Group info
  - /etc/sudoers – Users with admin rights
- 

 **Commands:**

Task	Command
Add User	sudo adduser username
Delete User	sudo deluser username
Modify User	sudo usermod -aG group username
Set Password	sudo passwd username
List Users	cut -d: -f1 /etc/passwd

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#### **Group Management:**

Task	Command
Add Group	sudo groupadd groupname
Delete Group	sudo groupdel groupname
List Groups	getent group
Add User to Group	sudo usermod -aG groupname username

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#### **Switching Users:**

```
su - username # Switch to another user  
whoami      # Check current user
```

#### **Special Groups:**

- **sudo** – Admin access
  - **wheel** – Admin group in some distributions
  - **users** – Regular login users
- 

#### **Lock/Unlock User:**

```
sudo passwd -l username # Lock user  
sudo passwd -u username # Unlock user
```

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#### **Key Differences:**

Feature	Windows	Linux
Create User	GUI / PowerShell	CLI (adduser)
Add to Group	GUI / PowerShell	usermod -aG
Admin Access	Administrator group	sudo group

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## 8. Computer Hardware – PC Basics, Components, and Peripherals

This section helps build a solid understanding of basic hardware used in computer systems, including internal components, external peripherals, and general concepts essential for IT support roles.

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### A. PC Basics – What Makes Up a Computer?

A computer is a combination of:

- **Hardware** (physical components)
  - **Software** (operating system and applications)
  - **Firmware** (permanent software stored in ROM/BIOS)
- 

### B. Core Internal Hardware Components

Component	Description
<b>Motherboard</b>	Main circuit board. Connects all components.
<b>CPU (Processor)</b>	Brain of the computer. Executes instructions.
<b>RAM (Memory)</b>	Temporary memory for active processes.
<b>Hard Disk Drive (HDD) / SSD</b>	Permanent data storage (OS, apps, files).
<b>Power Supply Unit (PSU)</b>	Converts electricity to usable form for components.
<b>BIOS/UEFI</b>	Firmware that initializes hardware and boots OS.
<b>GPU (Graphics Card)</b>	Renders images/videos. Integrated or dedicated.
<b>Cooling Systems</b>	Fans, heat sinks, liquid cooling to reduce heat.

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### C. Ports and Connectors

Type	Use
<b>USB (Type A/B/C)</b>	Connects keyboard, mouse, drives, etc.
<b>HDMI / VGA / DisplayPort</b>	Video output
<b>Ethernet Port</b>	Wired internet connection
<b>Audio Jacks</b>	Headphones, microphones
<b>Power Connector</b>	To power the system

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#### D. Input Devices

Device	Function
<b>Keyboard</b>	Typing commands
<b>Mouse</b>	Cursor movement and selection
<b>Scanner</b>	Converts paper documents to digital
<b>Microphone</b>	Captures sound
<b>Touchscreen</b>	Combines input & display
<b>Webcam</b>	Captures video for calls/recording

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#### E. Output Devices

Device	Function
<b>Monitor</b>	Visual output
<b>Printer</b>	Produces physical copies
<b>Speakers</b>	Audio output
<b>Projector</b>	Displays visual output on large surfaces

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#### F. Storage Devices

Type	Description
<b>HDD (Hard Disk Drive)</b>	Magnetic storage; slower; high capacity
<b>SSD (Solid State Drive)</b>	Fast, no moving parts, low power

Type	Description
USB Flash Drive	Portable, used for transfers
CD/DVD	Optical media, less common now
External HDD/SSD	Backup and extended storage

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## G. Firmware and Boot Process

1. **BIOS/UEFI** initializes hardware.
  2. **POST (Power-On Self-Test)** checks essential components.
  3. BIOS looks for **bootable media** (like a hard disk).
  4. Loads the **bootloader** (GRUB, Windows Boot Manager).
  5. Bootloader loads the **Operating System**.
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## H. Power and Cooling

Component	Function
SMPS	Converts 230V AC to 12V, 5V, etc.
Heat Sink	Absorbs and disperses heat from CPU/GPU
Fans	Circulates air to cool system
Thermal Paste	Between CPU and heat sink for heat conduction

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## I. Computer Performance Factors

- Processor speed (GHz)
  - Number of cores/threads
  - Amount and type of RAM (DDR3, DDR4, DDR5)
  - SSD vs. HDD storage
  - Graphics capability
  - System cooling
- 

## J. Troubleshooting Tips

<b>Problem</b>	<b>Likely Cause</b>
No Power	PSU failure or loose cables
No Display	GPU issue or monitor cable
Overheating	Fan not working, clogged vents
Slow PC	Low RAM or HDD instead of SSD

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## **9. Datacenter – Overview and Operations**

A **Datacenter** is a facility used to house computer systems and associated components like networking and storage systems. It's the backbone of IT services in most organizations.

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### **A. What is a Datacenter?**

A **datacenter** is a centralized location where:

- Servers and storage systems are kept.
- Network infrastructure interconnects all systems.
- Critical applications and data are hosted.

Used by:

- Enterprises
  - Cloud providers (like AWS, Azure)
  - Government/defense sectors
- 

### **B. Core Components of a Datacenter**

<b>Component</b>	<b>Role</b>
<b>Servers</b>	Provide processing power and run services/apps
<b>Storage Systems</b>	Hold user/application data (SAN, NAS, HDDs, SSDs)
<b>Networking Equipment</b>	Routers, switches, firewalls for communication
<b>Power Supply</b>	UPS systems, backup generators ensure uptime
<b>Cooling Systems</b>	Maintain optimal temperature to prevent overheating
<b>Racks</b>	Physical frame housing servers and other hardware
<b>Security Systems</b>	Physical + logical (CCTV, access control, firewalls)

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### C. Types of Datacenters

Type	Description
<b>Enterprise Datacenter</b>	Owned/operated by the organization
<b>Colocation Datacenter</b>	Shared space rented to multiple businesses
<b>Cloud Datacenter</b>	Operated by cloud providers (AWS, GCP, Azure)
<b>Edge Datacenter</b>	Located closer to the users for low latency

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### D. Power and Cooling Systems

- **Uninterruptible Power Supply (UPS):** Backup battery to avoid sudden shutdowns.
  - **Diesel Generators:** Long-term power backup.
  - **HVAC Systems:** Manage heat and airflow.
  - **Hot/Cold Aisle Containment:** Efficient cooling design.
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### E. Data Storage Systems

Type	Description
<b>SAN (Storage Area Network)</b>	High-speed networked storage
<b>NAS (Network Attached Storage)</b>	File-level storage shared over a network
<b>DAS (Direct Attached Storage)</b>	Storage directly connected to a server

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### F. Datacenter Security

#### 1. Physical Security

- Biometric scanners
- Surveillance cameras (CCTV)
- Security personnel

#### 2. Logical Security

- Firewalls, IDS/IPS
- VPNs
- Role-based access

### 3. Disaster Recovery & Backup

- Regular backups
  - Redundant hardware
  - Failover mechanisms
- 

## G. Virtualization in Datacenters

Virtualization enables:

- Running multiple VMs (Virtual Machines) on a single physical server
- Better resource utilization
- Easy backup and disaster recovery

**Hypervisors** (e.g., VMware, Hyper-V, KVM) manage virtual machines.

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## H. Cloud Datacenter vs. Traditional Datacenter

Cloud Datacenter	Traditional Datacenter
Pay-as-you-go model	Large upfront cost
Highly scalable	Fixed infrastructure
Managed by cloud provider	Managed internally
Access from anywhere	Limited to physical access

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## I. Datacenter Videos Summary (LinkedIn Course)

### First Scene: Introduction

- Overview of how datacenters power modern digital infrastructure.
- Real-world examples (e.g., Google data centers).

### Second Scene: Inside a Datacenter

- Shows hot/cold aisle layout.
- Emphasis on cooling, fire suppression, and cable management.

### Third Scene: Security and Reliability

- Disaster recovery importance.
  - High availability through clustering and redundancy.
-

## J. Best Practices

- Redundant components (RAID, dual power supplies)
  - Environmental monitoring
  - Centralized management dashboards
  - Access logging and audit trails
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## 10. Windows 10 – Implementation, Features, and Usage

Windows 10 is a widely used operating system by Microsoft, designed for personal computers, laptops, tablets, and embedded devices in business environments.

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### A. Key Features of Windows 10

Feature	Description
<b>Start Menu</b>	Combines Windows 7-style menu with Windows 8 tiles
<b>Virtual Desktops</b>	Multiple desktops for multitasking
<b>Cortana</b>	Personal assistant for voice commands and search
<b>Action Center</b>	Centralized location for notifications and settings
<b>Universal Apps</b>	Apps that run on all Windows 10 devices
<b>Microsoft Edge</b>	Lightweight browser replacing Internet Explorer
<b>DirectX 12</b>	Enhanced gaming and graphics performance
<b>Windows Hello</b>	Biometric authentication (face/fingerprint)

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### B. Windows 10 Editions (Common for ITIS Roles)

Edition	Use Case
<b>Home</b>	Personal computers
<b>Pro</b>	Business features like BitLocker, Remote Desktop
<b>Enterprise</b>	Large-scale deployments; more security & management tools
<b>Education</b>	Academic institutions

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### C. System Requirements

## **Component Minimum Requirement**

Processor	1 GHz or faster
RAM	1 GB (32-bit), 2 GB (64-bit)
Storage	16 GB (32-bit), 20 GB (64-bit)
Display	800x600 resolution
Graphics	DirectX 9 or later with WDDM driver

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## **D. Windows 10 Installation Process**

1. **Media Creation Tool or ISO** used to create bootable USB
  2. Boot from USB or DVD
  3. Choose language and edition
  4. Format partition (if required)
  5. Enter product key
  6. Install updates and drivers post-installation
- 

## **E. Security Features**

- **Windows Defender Antivirus** – Built-in protection from malware
  - **Firewall and Network Protection**
  - **BitLocker** – Encrypts hard drive to prevent data theft
  - **Windows Hello** – Biometric login
  - **Secure Boot** – Prevents boot-level malware
- 

## **F. Device and System Management**

Tool	Purpose
<b>Device Manager</b>	Manage hardware (driver updates, disabling)
<b>Task Manager</b>	Monitor processes, performance
<b>Event Viewer</b>	View logs for troubleshooting
<b>Disk Management</b>	Partition creation and formatting
<b>Control Panel &amp; Settings</b>	Change system configurations

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## G. User Account Types

- **Administrator:** Full control
- **Standard User:** Limited access
- **Guest:** Temporary access, minimal control

**User Account Control (UAC)** prompts for permission during admin-level tasks.

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## H. File Systems Supported

- **NTFS:** Default for Windows; supports permissions, encryption
- **FAT32:** Used for USBs; limited file size (4 GB)
- **exFAT:** Used for flash drives with larger file support

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## I. Windows Update and Patching

- Windows 10 supports **Automatic Updates**
- **Patch Tuesday:** Microsoft releases updates every second Tuesday
- Can defer or pause updates for control over reboots in enterprise settings

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## J. Customization & Accessibility

- **Themes and Dark Mode**
- **Magnifier and Narrator**
- **Ease of Access settings** for users with disabilities
- Desktop background, lock screen, and system colors are all customizable

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## K. Important Folders in Windows

Folder	Use
<b>System32</b>	Core system files
<b>Program Files</b>	Installed applications
<b>Users</b>	Contains user profiles
<b>Windows</b>	OS installation files

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## L. Common Windows 10 Commands (CMD)

Command	Purpose
ipconfig	View IP details
ping	Check network connectivity
sfc /scannow	Scan system file integrity
chkdsk	Check disk for errors
tasklist / taskkill	View/kill processes

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## M. Recovery & Troubleshooting Options

- **System Restore** – Rollback to a previous state
  - **Safe Mode** – Minimal startup for fixing boot issues
  - **Reset this PC** – Reinstall OS with/without keeping files
  - **Startup Repair** – Fix boot loader or system startup errors
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## 11. Files and Permissions (Windows & Linux)

Understanding how file permissions work is crucial for system administration, security, and access control in both **Windows** and **Linux** environments.

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### A. File and Folder Permissions in Windows

Windows uses **NTFS (New Technology File System)** which supports detailed file and folder permission management through:

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#### 1. NTFS Permissions

Permission	Description
Full Control	Read, write, change, delete, take ownership
Modify	Read, write, delete
Read & Execute	Open files and run programs
List Folder Contents	View files in a folder
Read	View files

Permission	Description
Write	Add files and folders

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## 2. User vs Group Permissions

- Users inherit permissions from groups they belong to.
  - Effective permission is the **most restrictive combination** (e.g., if user has "Full Control" but group has "Read", only Read is allowed unless overridden).
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## 3. Sharing vs NTFS Permissions

Type	Applies To	Priority
NTFS	Local or remote access	Higher priority
Sharing	Network access only	Lower priority

**Effective Permission = Most Restrictive of Share and NTFS**

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## 4. Changing Permissions

- Right-click file > Properties > Security tab
  - Can add/remove users/groups, modify permissions
  - Advanced settings allow you to:
    - Take ownership
    - Enable inheritance
    - Audit access attempts
- 

## 5. File Ownership

- By default, the **creator** of a file/folder is the **owner**.
  - Only owners or admins can change permissions or take ownership.
  - Ownership can be transferred under Advanced Security Settings.
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## 6. Auditing Access (Windows)

- Can log who accessed, modified, or tried to access a file.
- Set from **Security tab > Advanced > Auditing**

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## B. File Permissions in Linux

Linux uses a **user-group-other** model with **read (r)**, **write (w)**, and **execute (x)** permissions.

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### 1. Permission Structure (`ls -l`)

Example:

```
-rwxr-xr-- 1 bhuvana devs 1024 Jul 25 09:00 example.sh
```

#### Part Meaning

- File type (- for file, d for directory)

rwx Owner (user) permissions

r-x Group permissions

r-- Others (public) permissions

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### 2. Numeric Representation (`chmod`)

#### Permission Binary Octal

r (read) 4

w (write) 2

x (execute) 1

Examples:

- `chmod 755 file.txt` → `rwxr-xr-x`
  - `chmod 700 script.sh` → `rwx-----`
- 

### 3. Changing Permissions

```
chmod 755 filename # Change file mode
```

```
chown user:group file # Change owner and group
```

---

### 4. Sticky Bit, SUID, SGID

Feature	Symbol	Use
<b>Sticky Bit</b>	t	Used on shared folders like /tmp so only owner can delete files
<b>SUID</b>	s on user	Executes with file owner's privileges
<b>SGID</b>	s on group	Executes with group privileges or inherits group in folders

---

## 5. Linux Default Permissions (umask)

- umask sets default permission masking.
  - E.g., default 666 for files, 777 for dirs → umask 022 → files get 644, dirs get 755
- 

## 6. Examples

```
chmod +x script.sh      # Make script executable  
chmod 600 secret.txt    # Only owner can read/write  
chown bhuvana:admin file # Change ownership
```

---

## 7. Linux Access Control Lists (ACLs)

More fine-grained control beyond standard permissions.

```
setfacl -m u:alice:r-- file.txt  # Give read permission to user alice  
getfacl file.txt               # View ACL
```

---

## Done with **Section 11: Files and Permissions**

Next up:

## **Section 12: User and Group Management (Windows & Linux)**

Shall I continue?

Great! Here's the next section:

---

## **12. User and Group Management (Windows & Linux)**

Proper **user and group management** is essential for system administration, access control, and ensuring system security.

---

## **A. Windows User and Group Management**

Windows uses **Local Users and Groups** snap-in (in lusrmgr.msc) for user management on standalone or domain systems.

---

## 1. User Accounts

Each user has a **unique SID (Security Identifier)**. Types of users:

Type	Description
<b>Administrator</b>	Full control over system
<b>Standard User</b>	Limited access
<b>Guest</b>	Temporary login with limited access
<b>Service Accounts</b>	Used by system services

---

## 2. Groups in Windows

Groups simplify permission management by assigning access to multiple users at once.

Group	Purpose
<b>Administrators</b>	Full control
<b>Users</b>	Regular non-admin users
<b>Guests</b>	Temporary users
<b>Power Users</b>	Some admin privileges
<b>Remote Desktop Users</b>	Allow RDP access

---

## 3. Managing Users/Groups

Access via:

- **Computer Management > Local Users and Groups**
  - Control Panel > User Accounts
  - net user and net localgroup commands in CMD
- 

## 4. User Properties

Includes:

- Full name

- Description
  - Group membership
  - Account status (enabled/disabled)
  - Password settings (e.g., expiration, complexity)
- 

## 5. Useful Windows Commands

```
net user bhuvana /add  
net localgroup Administrators bhuvana /add  
net user bhuvana /delete
```

---

---

## B. Linux User and Group Management

Linux manages users and groups using files like /etc/passwd, /etc/shadow, /etc/group, and commands like useradd, groupadd.

---

### 1. Important Files

File	Purpose
------	---------

/etc/passwd	Stores user account info
/etc/shadow	Stores password hashes
/etc/group	Stores group info
/etc/gshadow	Stores secure group info

---

### 2. Creating Users and Groups

```
sudo adduser bhuvana      # Create user with home directory  
sudo useradd -m pavani    # Another way to add user  
sudo passwd bhuvana      # Set password  
  
sudo groupadd developers  # Create group  
sudo usermod -aG developers bhuvana # Add user to group
```

---

### 3. User Account Structure (`/etc/passwd`)

Each line represents a user:

```
username:x:UID:GID:comment:home_directory:shell
```

Example:

```
bhuvana:x:1001:1001:Bhuvana:/home/bhuvana:/bin/bash
```

---

### 4. Group Structure (`/etc/group`)

```
group_name:x:GID:members
```

Example:

```
developers:x:1002:bhuvana,pavani
```

---

### 5. User Account Management

Command	Description
---------	-------------

<code>id bhuvana</code>	Show user ID and groups
-------------------------	-------------------------

<code>groups bhuvana</code>	Show groups user belongs to
-----------------------------	-----------------------------

<code>deluser bhuvana</code>	Delete user
------------------------------	-------------

<code>delgroup developers</code>	Delete group
----------------------------------	--------------

---

### 6. Password Policies (Linux)

Managed via `/etc/login.defs`, `/etc/pam.d/` configs. Settings include:

- Password length
- Expiry
- Complexity
- Login retries

You can enforce policies using tools like:

```
chage -l bhuvana # View password aging info
```

```
chage -M 90 bhuvana # Set max password age to 90 days
```

---

### 13. Linux System Information and Directory Management

Understanding system information and managing directories are core Linux administrative tasks.

---

## A. System Information Commands

These commands help you gather details about the system:

Command	Description
uname -a	Kernel version and system info
hostname	Display system hostname
uptime	System uptime and load
top / htop	Real-time process monitoring
free -h	Memory usage
df -h	Disk space usage
du -sh <directory>	Size of a directory
lscpu	CPU architecture
lsblk	List all block devices (disks, partitions)
dmesg	Boot and kernel logs
vmstat	System performance stats
who / w	Show logged-in users
ps aux	List running processes

---

## B. Directory Structure in Linux

Linux follows the **Filesystem Hierarchy Standard (FHS)**. Important directories:

### Directory Purpose

/	Root of the filesystem
/home	User home directories
/etc	Configuration files
/bin	Essential user binaries
/sbin	System administration binaries
/var	Variable data (logs, spool)

## Directory Purpose

/usr	Secondary hierarchy for user data
/tmp	Temporary files
/dev	Device files
/proc	Kernel and process info (virtual filesystem)
/boot	Bootloader files
/opt	Optional software

---

## C. Directory Commands

### Command Description

pwd	Print current working directory
ls -l	List files with details
cd /path	Change directory
mkdir name	Create new directory
rmdir name	Remove empty directory
rm -r name	Remove non-empty directory
tree	View directory structure as a tree (install if needed)

---

## D. Permissions and Ownership

Each file/directory has:

- **User (u)** – owner
- **Group (g)** – user group
- **Others (o)** – everyone else

Permissions: r (read), w (write), x (execute)

Use ls -l to view:

```
drwxr-xr-- 1 bhuvana users 4096 Jul 26 2025 myfolder
```

---

## E. Commands to Modify Permissions

## **Command Description**

chmod    Change permissions

chown    Change ownership

chgrp    Change group ownership

Examples:

```
chmod 755 script.sh      # rwxr-xr-x
```

```
chown bhuvana script.sh  # Change owner to bhuvana
```

```
chgrp developers script.sh # Change group to developers
```

---

## **F. Permission Values**

### **Symbolic Numeric Meaning**

rwx      7      Full access

rw-      6      Read + write

r--      4      Read only

--x      1      Execute only

Example:

```
chmod 755 file
```

```
# Owner: rwx (7), Group: rx (5), Others: rx (5)
```

---

## **12. Linux Overview and Installation**

### **What is Linux?**

- Linux is a **free and open-source OS** based on **UNIX**.
- It uses the **Linux kernel** and supports multi-user, multitasking, and networking features.
- Popular Linux distributions: **Ubuntu, Fedora, CentOS, Red Hat, Kali Linux, Debian**

### **Linux Architecture**

1. **Kernel** – Core of the OS; handles CPU, memory, and device control.
2. **Shell** – Interface between user and kernel (command-line interpreter).
3. **Utilities** – Tools for system management (e.g., ps, top, ls, etc.)
4. **File System** – Hierarchical structure starting from / (root directory).

## Linux Distributions (Distros)

- Each distro includes:
  - Linux Kernel
  - Package manager (e.g., apt, yum)
  - Desktop environment (e.g., GNOME, KDE)
- **Server-focused distros:** CentOS, Red Hat, Debian
- **Desktop-focused distros:** Ubuntu, Linux Mint

## Linux Installation

- **Steps:**
  1. Download ISO of a distro (e.g., Ubuntu)
  2. Create a bootable USB using tools like Rufus
  3. Boot PC from USB and follow installation wizard
  4. Set partitions: / (root), /home, swap
  5. Choose desktop environment, username, password
  6. Complete installation and reboot

## Key Terms

- **GRUB:** Bootloader used in Linux
  - **Swap:** Virtual memory on disk used when RAM is full
  - **LVM (Logical Volume Management):** Flexible disk management system
- 

## 13. Linux Command Line

### Importance of Command Line

- Most Linux system administration is done through the **terminal**.
- Provides direct access to the **shell (bash, sh, zsh, etc.)**

### File System Navigation

- `pwd` – Print working directory
- `cd` – Change directory
- `ls` – List contents
- `mkdir` – Make directory
- `rmdir` – Remove directory

## File Operations

- touch filename – Create empty file
- cat file – View file contents
- nano, vi, gedit – Text editors
- cp, mv, rm – Copy, move, delete files
- chmod – Change file permissions
- chown – Change file owner

## System Info & Process Commands

- top, htop – System resource usage
- ps, kill, killall – Process management
- df -h – Disk usage
- free -m – Memory usage

## Package Management

- Ubuntu/Debian: apt-get, dpkg
- RHEL/CentOS: yum, rpm

## User & Permission Commands

- adduser, passwd, usermod, deluser
- chmod, chown, umask

## Permission Types

- **r** – read
- **w** – write
- **x** – execute

Example:

chmod 755 file

# rwxr-xr-x

## Useful Shortcuts

- Ctrl + C: Stop process
- Ctrl + Z: Send to background
- Tab: Auto-complete
- !!: Repeat last command

